IN THE CLAIMS

Please amend the claims as follows.

For the Examiner's convenience, a list of all claims is included below.

1. (Currently Amended) A machine-implemented method comprising:

extracting portions from speech segments, the portions surrounding a segment boundary within a phoneme;

identifying time samples from the portions;

constructing a matrix $W$ containing first data corresponding to the time samples from the portions surrounding the segment boundary within the phoneme and second data corresponding to the portions; and deriving feature vectors that represent the portions in a vector space by decomposing the matrix $W$ containing the first data corresponding to the time samples from the portions surrounding the segment boundary within the phoneme and the second data corresponding to the portions~~, such that at least phase information of the portions is preserved in the feature vectors~~; and

determining a distance between the feature vectors in the vector space.

2. (Canceled).

3. (Previously Presented) The machine-implemented method of claim 1, wherein decomposing the matrix $W$ comprises extracting global boundary-centric features from the portions.

4. (Previously Presented) The machine-implemented method of claim 1, wherein the speech segments each include the segment boundary within the phoneme.

5. (Original) The machine-implemented method of claim 4, wherein the speech segments each include at least one diphone.

6. (Original) The machine-implemented method of claim 5, wherein the portions include at least one pitch period.

7. (Original) The machine-implemented method of claim 6, wherein decomposing the matrix $W$ comprises performing a pitch synchronous singular value analysis on the pitch periods of the time-domain segments.

8. (Previously Presented) The machine-implemented method of claim 6, wherein the matrix $W$ is a $2KM \times N$ matrix represented by

$$W = U \Sigma V^T$$

where $K$ is the number of pitch periods near the segment boundary extracted from each segment, $N$ is the maximum number of samples among the pitch periods, $M$ is the number of segments in a voice table having a segment boundary within the phoneme, $U$ is the $2KM \times R$ left singular matrix with row vectors $u_i$ ($1 \leq i \leq 2KM$), $\Sigma$ is the $R \times R$ diagonal matrix of singular values $s_1 \geq s_2 \geq \ldots \geq s_R > 0$, $V$ is the $N \times R$ right singular matrix with row vectors $v_j$ ($1 \leq j \leq N$), $R << 2KM$, and $^T$ denotes matrix transposition, wherein decomposing the matrix $W$ comprises performing a singular value decomposition of $W$.

9. (Original) The machine-implemented method of claim 8, wherein the pitch periods are zero padded to $N$ samples.

10. (Original) The machine-implemented method of claim 9, wherein a feature vector $\bar{u}_i$ is calculated as

$$\bar{u}_i = u_i \Sigma$$

where $u_i$ is a row vector associated with a pitch period $i$, and $\Sigma$ is the singular diagonal matrix.

11. (Original) The machine-implemented method of claim 10, wherein the distance between two feature vectors is determined by a metric comprising the cosine of the angle between the two feature vectors.

12. (Original) The machine-implemented method of claim 11, wherein the metric comprises a closeness measure, $C$, between two feature vectors, $\bar{u}_k$ and $\bar{u}_l$, wherein $C$ is calculated as

$$C(\bar{u}_k, \bar{u}_l) = \cos(u_k\Sigma, u_l\Sigma) = \frac{u_k \Sigma^2 u_l^T}{\| u_k \Sigma \| \, \| u_l \Sigma \|}$$

for any $1 \leq k, l \leq 2KM$.

13. (Original) The machine-implemented method of claim 12, wherein a difference $d(S_1,S_2)$ between two segments in the voice table, $S_1$ and $S_2$, is calculated as

$$d(S_1,S_2) = d_0(p_1, q_1) = 1 - C(\bar{u}_{p1}, \bar{u}_{q1})$$

where $d_0$ is the distance between pitch periods $p_1$ and $q_1$, $p_1$ is the last pitch period of $S_1$, $q_1$ is the first pitch period of $S_2$, $\bar{u}_{p1}$ is a feature vector associated with pitch period $p_1$, and $\bar{u}_{q1}$ is a feature vector associated with pitch period $q_1$.

14. (Original) The machine-implemented method of claim 13, wherein the calculation for the difference between two segments in the voice table, $S_1$ and $S_2$, is expanded to include a plurality of pitch periods from each segment.

15. (Original) The machine-implemented method of claim 13, wherein the difference between two segments in the voice table, $S_1$ and $S_2$, is associated with a discontinuity between $S_1$ and $S_2$.

16. (Original) The machine-implemented method of claim 12, wherein a difference $d(S_1,S_2)$ between two segments in the voice table, $S_1$ and $S_2$, is calculated as

$$d(S_1,S_2) = \left| \frac{d_0(p_1, q_1) - d_0(p_1, \overline{p}_1) + d_0(q_1,\overline{q}_1)}{2} \right| = \left| \frac{C(\overline{u}_{p1},\overline{u}_{\overline{p}1}) + C(\overline{u}_{q1},\overline{u}_{\overline{q}1}) - C(\overline{u}_{p1},\overline{u}_{q1})}{2} \right|$$

where $d_0$ is the distance between pitch periods, $p_1$ is the last pitch period of $S_1$, $\overline{p}_1$ is the first pitch period of a segment contiguous to $S_1$, $q_1$ is the first pitch period of $S_2$, $\overline{q}_1$ is the last pitch period of a segment contiguous to $S_2$, $\overline{u}_{p1}$ is a feature vector associated with pitch period $p_1$, $\overline{u}_{q1}$ is a feature vector associated with pitch period $q_1$, $\overline{u}_{\overline{p}1}$ is a feature vector associated with pitch period $\overline{p}_1$, and $\overline{u}_{\overline{q}1}$ is a feature vector associated with pitch period $\overline{q}_1$.

17. (Previously Presented) The machine-implemented method of claim 1, further comprising associating the distance between the feature vectors with speech segments in a voice table.

18. (Original) The machine-implemented method of claim 17, further comprising:

selecting speech segments from the voice table based on the distance between the feature vectors.

19. (Original) The machine-implemented method of claim 5, wherein the portions include centered pitch periods.

20. (Previously Presented) The machine-implemented method of claim 19, wherein the matrix $W$ is a $(2(K\text{-}1)+1)M \times N$ matrix represented by

$$W = U \Sigma V^T$$

where $K$-1 is the number of centered pitch periods near the segment boundary extracted from each segment, $N$ is the maximum number of samples among the centered pitch periods, $M$ is the number of segments in a voice table having a segment boundary within the phoneme, $U$ is the $(2(K\text{-}1)+1)M \times R$ left singular matrix with row vectors $u_i$ $(1 \leq i \leq (2(K\text{-}1)+1)M)$, $\Sigma$ is the $R \times R$ diagonal matrix of singular values $s_1 \geq s_2 \geq \ldots \geq s_R > 0$, $V$ is the $N \times R$ right singular matrix with row vectors $v_j$ $(1 \leq j \leq N)$, $R << (2(K\text{-}1)+1)M)$, and $^T$ denotes matrix transposition, wherein decomposing the matrix $W$ comprises performing a singular value decomposition of $W$.

21. (Original) The machine-implemented method of claim 20, wherein the centered pitch periods are symmetrically zero padded to $N$ samples.

22. (Original) The machine-implemented method of claim 21, wherein a feature vector $\bar{u}_i$ is calculated as

$$\bar{u}_i = u_i \Sigma$$

where $u_i$ is a row vector associated with a centered pitch period $i$, and $\Sigma$ is the singular diagonal matrix.

23. (Original) The machine-implemented method of claim 22, wherein the distance between two feature vectors is determined by a metric comprising a closeness measure, $C$, between two feature vectors, $\bar{u}_k$ and $\bar{u}_l$, wherein $C$ is calculated as

$$C(\bar{u}_k, \bar{u}_l) = \cos(u_k\Sigma, u_l\Sigma) = \frac{u_k \Sigma^2 u_l^T}{\| u_k \Sigma \| \; \| u_l \Sigma \|}$$

for any $1 \leq k, l \leq (2(K\text{-}1)+1)M$.

24. (Original) The machine-implemented method of claim 23, wherein a difference $d(S_1,S_2)$ between two segments in the voice table, $S_1$ and $S_2$, is calculated as

$$d(S_1,S_2) = C(u_{\pi_{-1}}, u_{\delta_0}) + C(u_{\delta_0}, u_{\sigma_1}) - C(u_{\pi_{-1}}, u_{\pi_0}) - C(u_{\sigma_0}, u_{\sigma_1})$$

where $u_{\pi_{-1}}$ is a feature vector associated with a centered pitch period $\pi_{-1}$, $u_{\delta_0}$ is a feature vector associated with a centered pitch period $\delta_0$, $u_{\sigma_1}$ is a feature vector associated with a centered pitch period $\sigma_1$, $u_{\pi_0}$ is a feature vector associated with a centered pitch period $\pi_0$, and $u_{\sigma_0}$ is a feature vector associated with a centered pitch period $\sigma_0$.

25. (Currently Amended) A machine-readable medium having instructions to cause a machine to perform a machine-implemented method comprising:

extracting portions from speech segments that surround a segment boundary within a phoneme;

identifying time samples from the portions;

constructing a matrix $W$ containing first data corresponding to the time samples from the portions surrounding the segment boundary within the phoneme and second data corresponding to the portions; and deriving feature vectors that represent the portions in a vector space by decomposing the matrix $W$ containing the first data corresponding to the time samples from the portions surrounding the segment boundary within the phoneme and the second data corresponding to the portions~~, such that at least phase information of the portions is preserved in the feature vectors~~; and

determining a distance between the feature vectors in the vector space.

26. (Canceled).

27. (Previously Presented) The machine-readable medium of claim 25, wherein decomposing the matrix $W$ comprises extracting global boundary-centric features from the portions.

28. (Previously Presented) The machine-readable medium of claim 25, wherein the speech segments each include the segment boundary within the phoneme.

29. (Original) The machine-readable medium of claim 28, wherein the speech segments each include at least one diphone.

30. (Original) The machine-readable medium of claim 29, wherein the portions include at least one pitch period.

31. (Original) The machine-readable medium of claim 30, wherein decomposing the matrix $W$ comprises performing a pitch synchronous singular value analysis on the pitch periods of the time-domain segments.

32. (Previously Presented) The machine-readable medium of claim 30, wherein the matrix $W$ is a $2KM \times N$ matrix represented by

$$W = U \Sigma V^T$$

where $K$ is the number of pitch periods near the segment boundary extracted from each segment, $N$ is the maximum number of samples among the pitch periods, $M$ is the number of segments in a voice table having a segment boundary within the phoneme, $U$ is the $2KM \times R$ left singular matrix with row vectors $u_i$ ($1 \leq i \leq 2KM$), $\Sigma$ is the $R \times R$ diagonal matrix of singular values $s_1 \geq s_2 \geq \ldots \geq s_R > 0$, $V$ is the $N \times R$ right singular matrix with row vectors $v_j$ ($1 \leq j \leq N$), $R << 2KM$, and $^T$ denotes matrix transposition, wherein decomposing the matrix $W$ comprises performing a singular value decomposition of $W$.

33. (Original) The machine-readable medium of claim 32, wherein the pitch periods are zero padded to $N$ samples.

34. (Original) The machine-readable medium of claim 33, wherein a feature vector $\bar{u}_i$ is calculated as

$$\bar{u}_i = u_i \Sigma$$

where $u_i$ is a row vector associated with a pitch period $i$, and $\Sigma$ is the singular diagonal matrix.

35. (Original) The machine-readable medium of claim 34, wherein the distance between two feature vectors is determined by a metric comprising the cosine of the angle between the two feature vectors.

36. (Original) The machine-readable medium of claim 35, wherein the metric comprises a closeness measure, $C$, between two feature vectors, $\bar{u}_k$ and $\bar{u}_l$, wherein $C$ is calculated as

$$C(\bar{u}_k, \bar{u}_l) = \cos(u_k\Sigma, u_l\Sigma) = \frac{u_k \Sigma^2 u_l^T}{\| u_k \Sigma \| \; \| u_l \Sigma \|}$$

for any $1 \leq k, l \leq 2KM$.

37. (Original) The machine-readable medium of claim 36, wherein a difference $d(S_1,S_2)$ between two segments in the voice table, $S_1$ and $S_2$, is calculated as

$$d(S_1,S_2) = d_0(p_1, q_1) = 1 - C(\bar{u}_{p1}, \bar{u}_{q1})$$

where $d_0$ is the distance between pitch periods $p_1$ and $q_1$, $p_1$ is the last pitch period of $S_1$, $q_1$ is the first pitch period of $S_2$, $\bar{u}_{p1}$ is a feature vector associated with pitch period $p_1$, and $\bar{u}_{q1}$ is a feature vector associated with pitch period $q_1$.

38. (Original) The machine-readable medium of claim 37, wherein the calculation for the difference between two segments in the voice table, $S_1$ and $S_2$, is expanded to include a plurality of pitch periods from each segment.

39. (Original) The machine-readable medium of claim 37, wherein the difference between two segments in the voice table, $S_1$ and $S_2$, is associated with a discontinuity between $S_1$ and $S_2$.

40. (Original) The machine-readable medium of claim 36, wherein a difference $d(S_1,S_2)$ between two segments in the voice table, $S_1$ and $S_2$, is calculated as

$$d(S_1,S_2) = \left| \frac{d_0(p_1, q_1) - d_0(p_1, \overline{p}_1) + d_0(q_1, \overline{q}_1)}{2} \right| = \left| \frac{C(\overline{u}_{p1}, \overline{u}_{\overline{p}1}) + C(\overline{u}_{q1}, \overline{u}_{\overline{q}1}) - C(\overline{u}_{p1}, \overline{u}_{q1})}{2} \right|$$

where $d_0$ is the distance between pitch periods, $p_1$ is the last pitch period of $S_1$, $\overline{p}_1$ is the first pitch period of a segment contiguous to $S_1$, $q_1$ is the first pitch period of $S_2$, $\overline{q}_1$ is the last pitch period of a segment contiguous to $S_2$, $\overline{u}_{p1}$ is a feature vector associated with pitch period $p_1$, $\overline{u}_{q1}$ is a feature vector associated with pitch period $q_1$, $\overline{u}_{\overline{p}1}$ is a feature vector associated with pitch period $\overline{p}_1$, and $\overline{u}_{\overline{q}1}$ is a feature vector associated with pitch period $\overline{q}_1$.

41. (Previously Presented) The machine-readable medium of claim 25, wherein the method further comprises associating the distance between the feature vectors with speech segments in a voice table.

42. (Original) The machine-readable medium of claim 41, wherein the method further comprises:

selecting speech segments from the voice table based on the distance between the feature vectors.

43. (Original) The machine-readable medium of claim 29, wherein the portions include centered pitch periods.

44. (Previously Presented) The machine-readable medium of claim 43, wherein the matrix $W$ is a $(2(K-1)+1)M \times N$ matrix represented by

$$W = U \Sigma V^T$$

where $K$-1 is the number of centered pitch periods near the segment boundary extracted from each segment, $N$ is the maximum number of samples among the centered pitch periods, $M$ is the number of segments in a voice table having a segment boundary within the phoneme, $U$ is the $(2(K-1)+1)M \times R$ left singular matrix with row vectors $u_i$ $(1 \leq i \leq (2(K-1)+1)M)$, $\Sigma$ is the $R \times R$ diagonal matrix of singular values $s_1 \geq s_2 \geq \ldots \geq s_R > 0$, $V$ is the $N \times R$ right singular matrix with row vectors $v_j$ $(1 \leq j \leq N)$, $R << (2(K-1)+1)M)$, and $^T$ denotes matrix transposition, wherein decomposing the matrix $W$ comprises performing a singular value decomposition of $W$.

45. (Original) The machine-readable medium of claim 44, wherein the centered pitch periods are symmetrically zero padded to $N$ samples.

46. (Original) The machine-readable medium of claim 45, wherein a feature vector $\bar{u}_i$ is calculated as

$$\bar{u}_i = u_i \Sigma$$

where $u_i$ is a row vector associated with a centered pitch period $i$, and $\Sigma$ is the singular diagonal matrix.

47. (Original) The machine-readable medium of claim 46, wherein the distance between two feature vectors is determined by a metric comprising a closeness measure, $C$, between two feature vectors, $\bar{u}_k$ and $\bar{u}_l$, wherein $C$ is calculated as

$$C(\bar{u}_k, \bar{u}_l) = \cos(u_k\Sigma, u_l\Sigma) = \frac{u_k \Sigma^2 u_l^T}{\| u_k \Sigma \| \, \| u_l \Sigma \|}$$

for any $1 \leq k, l \leq (2(K\text{-}1)+1)M$.

48. (Original) The machine-readable medium of claim 47, wherein a difference $d(S_1,S_2)$ between two segments in the voice table, $S_1$ and $S_2$, is calculated as

$$d(S_1,S_2) = C(u\pi_{-1}, u\delta_0) + C(u\delta_0, u\sigma_1) - C(u\pi_{-1}, u\pi_0) - C(u\sigma_0, u\sigma_1)$$

where $u\pi_{-1}$ is a feature vector associated with a centered pitch period $\pi_{-1}$, $u\delta_0$ is a feature vector associated with a centered pitch period $\delta_0$, $u\sigma_1$ is a feature vector associated with a centered pitch period $\sigma_1$, $u\pi_0$ is a feature vector associated with a centered pitch period $\pi_0$, and $u\sigma_0$ is a feature vector associated with a centered pitch period $\sigma_0$.

49. (Currently Amended) An apparatus comprising:

means for extracting portions from speech segments, the portions surrounding a segment boundary within a phoneme;

means for identifying time samples from the portions;

means for constructing a matrix $W$ containing <u>first data corresponding to</u> the time samples from the portions surrounding the segment boundary within the phoneme <u>and</u>

second data corresponding to the portions; and means for deriving feature vectors that represent the portions in a vector space by decomposing the matrix $W$ containing the first data corresponding to the time samples from ~~the~~ the portions surrounding the segment boundary within the phoneme and the second data corresponding to the portions~~, such that at least phase information of the portions is preserved in the feature vectors~~; and

means for determining a distance between the feature vectors in the vector space.

50. (Canceled).

51. (Previously Presented) The apparatus of claim 49, wherein the means for decomposing the matrix $W$ comprises means for extracting global boundary-centric features from the portions.

52. (Previously Presented) The apparatus of claim 49, wherein the speech segments each include the segment boundary within the phoneme.

53. (Original) The apparatus of claim 52, wherein the speech segments each include at least one diphone.

54. (Original) The apparatus of claim 53, wherein the portions include at least one pitch period.

55. (Original) The apparatus of claim 54, wherein the means for decomposing the matrix $W$ comprises means for performing a pitch synchronous singular value analysis on the pitch periods of the time-domain segments.

56. (Previously Presented) The apparatus of claim 54, wherein the matrix $W$ is a $2KM \times N$ matrix represented by

$$W = U \Sigma V^T$$

where $K$ is the number of pitch periods near the segment boundary extracted from each segment, $N$ is the maximum number of samples among the pitch periods, $M$ is the number of segments in a voice table having a segment boundary within the phoneme, $U$ is the $2KM \times R$ left singular matrix with row vectors $u_i$ $(1 \leq i \leq 2KM)$, $\Sigma$ is the $R \times R$ diagonal matrix of singular values $s_1 \geq s_2 \geq \ldots \geq s_R > 0$, $V$ is the $N \times R$ right singular matrix with row vectors $v_j$ $(1 \leq j \leq N)$, $R << 2KM$, and $^T$ denotes matrix transposition, wherein decomposing the matrix $W$ comprises performing a singular value decomposition of $W$.

57. (Original) The apparatus of claim 56, wherein the pitch periods are zero padded to $N$ samples.

58. (Original) The apparatus of claim 57, wherein a feature vector $\bar{u}_i$ is calculated as

$$\bar{u}_i = u_i \Sigma$$

where $u_i$ is a row vector associated with a pitch period $i$, and $\Sigma$ is the singular diagonal matrix.

59. (Original) The apparatus of claim 58, wherein the distance between two feature vectors is determined by a metric comprising the cosine of the angle between the two feature vectors.

60. (Original) The apparatus of claim 59, wherein the metric comprises a closeness measure, $C$, between two feature vectors, $\bar{u}_k$ and $\bar{u}_l$, wherein $C$ is calculated as

$$C(\bar{u}_k, \bar{u}_l) = \cos(u_k\Sigma, u_l\Sigma) = \frac{u_k \Sigma^2 u_l^T}{\left\| u_k \Sigma \right\| \left\| u_l \Sigma \right\|}$$

for any $1 \leq k, l \leq 2KM$.

61. (Original) The apparatus of claim 60, wherein a difference $d(S_1,S_2)$ between two segments in the voice table, $S_1$ and $S_2$, is calculated as

$$d(S_1,S_2) = d_0(p_1, q_1) = 1 - C(\bar{u}_{p1}, \bar{u}_{q1})$$

where $d_0$ is the distance between pitch periods $p_1$ and $q_1$, $p_1$ is the last pitch period of $S_1$, $q_1$ is the first pitch period of $S_2$, $\bar{u}_{p1}$ is a feature vector associated with pitch period $p_1$, and $\bar{u}_{q1}$ is a feature vector associated with pitch period $q_1$.

62. (Original) The apparatus of claim 61, wherein the calculation for the difference between two segments in the voice table, $S_1$ and $S_2$, is expanded to include a plurality of pitch periods from each segment.

63. (Original) The apparatus of claim 61, wherein the difference between two segments in the voice table, $S_1$ and $S_2$, is associated with a discontinuity between $S_1$ and $S_2$.

64. (Original) The apparatus of claim 60, wherein a difference $d(S_1,S_2)$ between two segments in the voice table, $S_1$ and $S_2$, is calculated as

$$d(S_1,S_2) = \left| \frac{d_0(p_1, q_1) - d_0(p_1, \overline{p}_1) + d_0(q_1, \overline{q}_1)}{2} \right| = \left| \frac{C(\overline{u}_{p1}, \overline{u}_{\overline{p}1}) + C(\overline{u}_{q1}, \overline{u}_{\overline{q}1}) - C(\overline{u}_{p1}, \overline{u}_{q1})}{2} \right|$$

where $d_0$ is the distance between pitch periods, $p_1$ is the last pitch period of $S_1$, $\overline{p}_1$ is the first pitch period of a segment contiguous to $S_1$, $q_1$ is the first pitch period of $S_2$, $\overline{q}_1$ is the last pitch period of a segment contiguous to $S_2$, $\overline{u}_{p1}$ is a feature vector associated with pitch period $p_1$, $\overline{u}_{q1}$ is a feature vector associated with pitch period $q_1$, $\overline{u}_{\overline{p}1}$ is a feature vector associated with pitch period $\overline{p}_1$, and $\overline{u}_{\overline{q}1}$ is a feature vector associated with pitch period $\overline{q}_1$.

65. (Previously Presented) The apparatus of claim 49, further comprising means for associating the distance between the feature vectors with speech segments in a voice table.

66. (Original) The apparatus of claim 65, further comprising:

means for selecting speech segments from the voice table based on the distance between the feature vectors.

67. (Original) The apparatus of claim 53, wherein the portions include centered pitch periods.

68. (Previously Presented) The apparatus of claim 67, wherein the matrix $W$ is a $(2(K\text{-}1)+1)M \times N$ matrix represented by

$$W = U \Sigma V^T$$

where $K$-1 is the number of centered pitch periods near the segment boundary extracted from each segment, $N$ is the maximum number of samples among the centered pitch periods, $M$ is the number of segments in a voice table having a segment boundary within the phoneme, $U$ is the $(2(K\text{-}1)+1)M \times R$ left singular matrix with row vectors $u_i$ $(1 \leq i \leq (2(K\text{-}1)+1)M)$, $\Sigma$ is the $R \times R$ diagonal matrix of singular values $s_1 \geq s_2 \geq \ldots \geq s_R > 0$, $V$ is the $N \times R$ right singular matrix with row vectors $v_j$ $(1 \leq j \leq N)$, $R \ll (2(K\text{-}1)+1)M)$, and $^T$ denotes matrix transposition, wherein decomposing the matrix $W$ comprises performing a singular value decomposition of $W$.

69. (Original) The apparatus of claim 68, wherein the centered pitch periods are symmetrically zero padded to $N$ samples.

70. (Original) The apparatus of claim 69, wherein a feature vector $\bar{u}_i$ is calculated as

$$\bar{u}_i = u_i \Sigma$$

where $u_i$ is a row vector associated with a centered pitch period $i$, and $\Sigma$ is the singular diagonal matrix.

71. (Original) The apparatus of claim 70, wherein the distance between two feature vectors is determined by a metric comprising a closeness measure, $C$, between two feature vectors, $\bar{u}_k$ and $\bar{u}_l$, wherein $C$ is calculated as

$$C(\bar{u}_k, \bar{u}_l) = \cos(u_k\Sigma, u_l\Sigma) = \frac{u_k \Sigma^2 u_l^T}{\| u_k \Sigma \| \; \| u_l \Sigma \|}$$

for any $1 \leq k, l \leq (2(K\text{-}1)+1)M$.

72. (Original) The apparatus of claim 71, wherein a difference $d(S_1,S_2)$ between two segments in the voice table, $S_1$ and $S_2$, is calculated as

$$d(S_1,S_2) = C(u\pi_{-1}, u\delta_0) + C(u\delta_0, u\sigma_1) - C(u\pi_{-1}, u\pi_0) - C(u\sigma_0, u\sigma_1)$$

where $u\pi_{-1}$ is a feature vector associated with a centered pitch period $\pi_{-1}$, $u\delta_0$ is a feature vector associated with a centered pitch period $\delta_0$, $u\sigma_1$ is a feature vector associated with a centered pitch period $\sigma_1$, $u\pi_0$ is a feature vector associated with a centered pitch period $\pi_0$, and $u\sigma_0$ is a feature vector associated with a centered pitch period $\sigma_0$.

73. (Currently Amended) A system comprising:

a processing unit coupled to a memory through a bus; and

wherein the processing unit is configured, for a process, to extract portions from speech segments, the portions surrounding a segment boundary within a phoneme, identify time samples from the portions; construct a matrix $W$ containing first data corresponding to the time samples from the portions surrounding the segment boundary within the phoneme

and second data corresponding to the portions, and derive feature vectors that represent the portions in a vector space by decomposing the matrix *W* containing the first data corresponding to the time samples from the portions surrounding the segment boundary within the phoneme and the second data corresponding to the portions~~, such that at least phase information of the portions is preserved in the feature vectors~~, and determine a distance between the feature vectors in the vector space.

74. (Canceled).

75. (Previously Presented) The system of claim 73, wherein the process further causes the processing unit, when decomposing the matrix *W*, to extract global boundary-centric features from the portions.

76. (Previously Presented) The system of claim 73, wherein the speech segments each include the segment boundary within the phoneme.

77. (Original) The system of claim 76, wherein the speech segments each include at least one diphone.

78. (Original) The system of claim 77, wherein the portions include at least one pitch period.

79. (Original) The system of claim 78, wherein the process further causes the processing unit, when decomposing the matrix $W$, to perform a pitch synchronous singular value analysis on the pitch periods of the time-domain segments.

80. (Previously Presented) The system of claim 78, wherein the matrix $W$ is a $2KM \times N$ matrix represented by

$W = U \Sigma V^T$

where $K$ is the number of pitch periods near the segment boundary extracted from each segment, $N$ is the maximum number of samples among the pitch periods, $M$ is the number of segments in a voice table having a segment boundary within the phoneme, $U$ is the $2KM \times R$ left singular matrix with row vectors $u_i$ ($1 \leq i \leq 2KM$), $\Sigma$ is the $R \times R$ diagonal matrix of singular values $s_1 \geq s_2 \geq \ldots \geq s_R > 0$, $V$ is the $N \times R$ right singular matrix with row vectors $v_j$ ($1 \leq j \leq N$), $R << 2KM$, and $^T$ denotes matrix transposition, wherein decomposing the matrix $W$ comprises performing a singular value decomposition of $W$.

81. (Original) The system of claim 80, wherein the pitch periods are zero padded to $N$ samples.

82. (Original) The system of claim 81, wherein a feature vector $\bar{u}_i$ is calculated as

$$\bar{u}_i = u_i \Sigma$$

where $u_i$ is a row vector associated with a pitch period $i$, and $\Sigma$ is the singular diagonal matrix.

83. (Original) The system of claim 82, wherein the distance between two feature vectors is determined by a metric comprising the cosine of the angle between the two feature vectors.

84. (Original) The system of claim 83, wherein the metric comprises a closeness measure, $C$, between two feature vectors, $\bar{u}_k$ and $\bar{u}_l$, wherein $C$ is calculated as

$$C(\bar{u}_k, \bar{u}_l) = \cos(u_k\Sigma, u_l\Sigma) = \frac{u_k \Sigma^2 u_l^T}{\left\| u_k \Sigma \right\| \left\| u_l \Sigma \right\|}$$

for any $1 \leq k, l \leq 2KM$.

85. (Original) The system of claim 84, wherein a difference $d(S_1,S_2)$ between two segments in the voice table, $S_1$ and $S_2$, is calculated as

$$d(S_1,S_2) = d_0(p_1, q_1) = 1 - C(\bar{u}_{p1}, \bar{u}_{q1})$$

where $d_0$ is the distance between pitch periods $p_1$ and $q_1$, $p_1$ is the last pitch period of $S_1$, $q_1$ is the first pitch period of $S_2$, $\bar{u}_{p1}$ is a feature vector associated with pitch period $p_1$, and $\bar{u}_{q1}$ is a feature vector associated with pitch period $q_1$.

86. (Original) The system of claim 85, wherein the calculation for the difference between two segments in the voice table, $S_1$ and $S_2$, is expanded to include a plurality of pitch periods from each segment.

87. (Original) The system of claim 85, wherein the difference between two segments in the voice table, $S_1$ and $S_2$, is associated with a discontinuity between $S_1$ and $S_2$.

88. (Original) The system of claim 84, wherein a difference $d(S_1,S_2)$ between two segments in the voice table, $S_1$ and $S_2$, is calculated as

$$d(S_1,S_2) = \left| \frac{d_0(p_1, q_1) - d_0(p_1, \overline{p}_1) + d_0(q_1,\overline{q}_1)}{2} \right| = \left| \frac{C(\overline{u}_{p1},\overline{u}_{\overline{p}1}) + C(\overline{u}_{q1},\overline{u}_{\overline{q}1}) - C(\overline{u}_{p1},\overline{u}_{q1})}{2} \right|$$

where $d_0$ is the distance between pitch periods, $p_1$ is the last pitch period of $S_1$, $\overline{p}_1$ is the first pitch period of a segment contiguous to $S_1$, $q_1$ is the first pitch period of $S_2$, $\overline{q}_1$ is the last pitch period of a segment contiguous to $S_2$, $\overline{u}_{p1}$ is a feature vector associated with pitch period $p_1$, $\overline{u}_{q1}$ is a feature vector associated with pitch period $q_1$, $\overline{u}_{\overline{p}1}$ is a feature vector associated with pitch period $\overline{p}_1$, and $\overline{u}_{\overline{q}1}$ is a feature vector associated with pitch period $\overline{q}_1$.

89. (Previously Presented) The system of claim 74, wherein the process further causes the processing unit to associate the distance between the feature vectors with speech segments in a voice table.

90. (Original) The system of claim 89, wherein the process further causes the processing unit to select speech segments from the voice table based on the distance between the feature vectors.

91. (Original) The system of claim 77, wherein the portions include centered pitch periods.

92. (Previously Presented) The system of claim 91, wherein the matrix $W$ is a $(2(K\text{-}1)+1)M \times N$ matrix represented by

$$W = U \Sigma V^T$$

where $K$-1 is the number of centered pitch periods near the segment boundary extracted from each segment, $N$ is the maximum number of samples among the centered pitch periods, $M$ is the number of segments in a voice table having a segment boundary within the phoneme, $U$ is the $(2(K\text{-}1)+1)M \times R$ left singular matrix with row vectors $u_i$ $(1 \leq i \leq (2(K\text{-}1)+1)M)$, $\Sigma$ is the $R \times R$ diagonal matrix of singular values $s_1 \geq s_2 \geq \ldots \geq s_R > 0$, $V$ is the $N \times R$ right singular matrix with row vectors $v_j$ $(1 \leq j \leq N)$, $R << (2(K\text{-}1)+1)M)$, and $^T$ denotes matrix transposition, wherein decomposing the matrix $W$ comprises performing a singular value decomposition of $W$.

93. (Original) The system of claim 92, wherein the centered pitch periods are symmetrically zero padded to $N$ samples.

94. (Original) The system of claim 93, wherein a feature vector $\bar{u}_i$ is calculated as

$$\bar{u}_i = u_i \Sigma$$

where $u_i$ is a row vector associated with a centered pitch period $i$, and $\Sigma$ is the singular diagonal matrix.

95. (Original) The system of claim 94, wherein the distance between two feature vectors is determined by a metric comprising a closeness measure, $C$, between two feature vectors, $\bar{u}_k$ and $\bar{u}_l$, wherein $C$ is calculated as

$$C(\bar{u}_k, \bar{u}_l) = \cos(u_k\Sigma, u_l\Sigma) = \frac{u_k \Sigma^2 u_l^T}{\| u_k \Sigma \| \ \| u_l \Sigma \|}$$

for any $1 \leq k, l \leq (2(K\text{-}1)+1)M$.

96. (Original) The system of claim 95, wherein a difference $d(S_1,S_2)$ between two segments in the voice table, $S_1$ and $S_2$, is calculated as

$$d(S_1,S_2) = C(u\pi_{-1}, u\delta_0) + C(u\delta_0, u\sigma_1) - C(u\pi_{-1}, u\pi_0) - C(u\sigma_0, u\sigma_1)$$

where $u\pi_{-1}$ is a feature vector associated with a centered pitch period $\pi_{-1}$, $u\delta_0$ is a feature vector associated with a centered pitch period $\delta_0$, $u\sigma_1$ is a feature vector associated with a centered pitch period $\sigma_1$, $u\pi_0$ is a feature vector associated with a centered pitch period $\pi_0$, and $u\sigma_0$ is a feature vector associated with a centered pitch period $\sigma_0$.

97. (Currently Amended) A machine-implemented method comprising:

gathering time-domain samples from recorded speech segments, wherein the time-domain samples include time samples of pitch periods surrounding a segment boundary within a phoneme;

constructing a matrix containing first data corresponding to the time samples of the pitch periods surrounding the segment boundary within the phoneme and second data corresponding to the pitch periods and deriving feature vectors that represent the time samples in a vector space by decomposing the matrix containing the first data corresponding to the time samples of the pitch periods surrounding the segment boundary

within the phoneme and the second data corresponding to the pitch periods~~, such that at least phase information of the time samples is preserved in the feature vectors~~;

determining a discontinuity between the segments, the discontinuity based on a distance between the features.

98. (Canceled).

99. (Previously Presented) The machine-implemented method of claim 97, wherein the features incorporate phase information of the pitch periods.

100. (Canceled).

101. (Currently Amended) A machine-readable medium having instructions to cause a machine to perform a machine-implemented method comprising:

gathering time-domain samples from recorded speech segments, wherein the time-domain samples include time samples of pitch periods surrounding a segment boundary within a phoneme;

constructing a matrix containing first data corresponding to the time samples of the pitch periods surrounding the segment boundary within the phoneme and second data corresponding to the pitch periods and deriving feature vectors that represent the time samples in a vector space by decomposing the matrix containing the first data corresponding to the time samples of the pitch periods surrounding the segment boundary

within the phoneme and the second data corresponding the pitch periods~~, such that at least phase information of the time samples is preserved in the feature vectors~~;

determining a discontinuity between the segments, the discontinuity based on a distance between the features.

102. (Canceled).

103. (Previously Presented) The machine-readable medium of claim 101, wherein the features incorporate phase information of the pitch periods.

104. (Canceled).

105. (Currently Amended) An apparatus comprising:

means for gathering time-domain samples from recorded speech segments, wherein the time-domain samples include time samples of pitch periods surrounding a segment boundary within a phoneme;

means for constructing a matrix containing first data corresponding to the time samples of the pitch periods surrounding the segment boundary within the phoneme and second data corresponding to the pitch periods and deriving feature vectors that represent the time samples in a vector space by decomposing the matrix containing the first data corresponding to the the time domain samples of the pitch periods surrounding the segment boundary within the phoneme and the second data corresponding to the pitch

periods~~, such that at least phase information of the time samples is preserved in the feature vectors~~;

means for determining a discontinuity between the segments, the discontinuity based on a distance between the features.

106. (Canceled).

107. (Previously Presented) The apparatus of claim 105, wherein the features incorporate phase information of the pitch periods.

108. (Canceled).

109. (Currently Amended) A system comprising:

a processing unit coupled to a memory through a bus; and

a process executed from the memory by the processing unit to cause the processing unit to gather time-domain samples from recorded speech segments, wherein the time-domain samples include time samples of pitch periods surrounding a segment boundary within a phoneme, constructing a matrix containing first data corresponding to the time-domain samples of the pitch periods surrounding the segment boundary within the phoneme and second data corresponding to the pitch periods and deriving feature vectors that represent the time samples in a vector space by decomposing the matrix containing the first data corresponding to the time domain samples of the pitch periods surrounding the segment boundary within the phoneme and the second data corresponding to the pitch periods~~,~~

~~such that at least phase information of the time samples is preserved in the feature vectors~~; and determine a discontinuity between the segments, the discontinuity based on a distance between the features.

110. (Canceled).

111. (Previously Presented) The system of claim 109, wherein the features incorporate phase information of the pitch periods.

112. (Canceled).